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MAGIC MUSHROOMS

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Magic Mushrooms

Throughout history, man has used many types of natural substances for their psychoactive effects. The recorded history of Central and South America, in particular, is rich with descriptions of the use of roots, barks, seeds, mushrooms, and other substances for medical, religious, and mind-enhancing purposes (Schultes, 1966). Recently, one natural psychoactive has been receiving a great deal of attention in British Columbia. This is the so-called "magic" mushroom, which grows abundantly in some of the most densely populated regions of the province. There are several species of psychoactive mushrooms indigenous to B.C., but the most common belong to the genus Psilocybe and contain the active chemical psilocybin. The recent interest in psilocybin mushrooms has arisen from a combination of factors including psilocybin's powerful psychoactive effects, the wide availability of magic mushrooms during certain periods of the year, and controversy surrounding the mushroom's legal status. At the present time, possession of psilocybin mushrooms in Canada is considered to be legal.

In discussing the use of psilocybin mushrooms in B.C., several concerns are readily apparent. Perhaps the most obvious concerns have to do with what psilocybin mushrooms are in terms of their history, pharmacology, and effects. When were mushrooms first used for their hallucinogenic properties, how did psilocybin come to be used as a recreational drug, how does psilocybin affect the body, and what are the potential adverse consequences of use? It is also necessary to examine the nature and extent of magic mushroom use and to determine whether or not use appears to be increasing or decreasing. Certain other important issues that will be discussed are related to the mushroom's legal status and to it's rather unique position of being the only popular psychoactive which grows naturally in B.C. Indeed, it would be very difficult, if not impossible, to eradicate psilocybin mushrooms from this province. Unlike Cannabis sativa (marijuana) which will grow in B.C., but must for all intents and purposes be cultivated, psilocybin mushrooms pop up untended and frequently unwanted in locations from farmers' fields to city gardens. It is hoped that by studying magic mushroom use in British Columbia from a variety of perspectives, a better understanding of this phenomenon will emerge.

History

The use of mushrooms for their psychoactive properties is not a practice unique to recent times. There is evidence for the existence of a mushroom cult among the pre-Mayan civilizations as long ago as 2,500 B.C. Many so-called "mushroom stones" were unearthed before the turn of the century in Guatemala, Mexico, and San Salvador (Encyclopedia of Mushrooms, 1979). The stones are in the shape of mushrooms and usually stand 30 cm to 35 cm in height. They frequently embody human figures or faces and some of the facial expressions depict a trance-like state suggestive of drug intoxication. At first, the stones were believed to be phallic symbols, but later investigations provided support for the theory that the stones were related to a magico-religious mushroom cult (Lowy, 1971; McDonald, 1980; Pollock, 1977-78).

Hallucinogenic mushrooms were referred to by the natives as "teonanacatl", which means food or flesh of the gods. The natives believed that these sacred mushrooms were given to man by the gods as food for his inner development. The mushrooms also played an important role in healing ceremonies and divinatory rites (Pollock, 1977-78; Singer, 1958). The prominent role of psychoactive mushrooms in these native cultures is believed to have continued for many centuries until the arrival of the Spaniards in the 16th century. The Spaniards brought with them the oppression of the Spanish Inquisition and attempted to suppress all native non-Christian religious practices. As a result, the use of teonanacatl was driven underground and into remote areas (Lowy, 1972; McDonald, 1980; Pollock, 1977-78).

It is not surprising, then, that the existence of mushroom cults in Mexico, Guatemala, and San Salvador remained virtually unnoticed until the mid-1950's. At that time, field work by R. Gordon Wasson and his wife, Valentina Pavlovna, uncovered the link between the current use of hallucinogenic mushrooms in Mexico and the ancient mushroom cults (Lowy, 1971). The Wassons found that psychoactive mushrooms containing psilocybin were currently being used in Mexico for ceremonial purposes. Ceremonies presided over by a curandero (priest) or curandera (priestess) were conducted for such purposes as removing a hex, determining the prognosis of an illness, or finding the location of lost articles. On some occasions the sacred mushrooms were consumed by the curandero alone, but at other times they were eaten by all those attending the ceremony (Pollock, 1977-78; Singer, 1958). While in Mexico, the Wassons attended a mushroom ceremony and ingested psilocybin mushrooms under the guidance of a curandera. Their experiences received widespread publicity through an article which appeared in 1957 in Life Magazine (Wasson , 1957). This publicity stimulated world-wide interest in psychoactive mushrooms at a time when curiousity about many hallucinogenic substances was just beginning. A continual stream of those seeking to experience the effects of "magic" mushrooms, as they were called, began to flow into Mexico. In very short order, the existence of psychoactive mushrooms of the Psilocybe and other genuses throughout North America, Asia, and Europe became apparent (McDonald, 1980; Pollock, 1975-76 and 1977-78). Magazines of the 1960's and early 1970's, such as "High Times", which were directed primarily at drug-using youth, carried numerous advertisements for kits for growing psilocybin mushrooms at home. Around this time, books written by Carlos Castenada appeared concerning his apprenticeship to the sorcerer Don Juan. Don Juan instructed his apprentice in many spiritual matters, including means of using smoke obtained from burning magic mushrooms to alter consciousness and achieve a "separate reality" (Castenada, 1968 & 1971). Thus, from the 1960's onward, magic mushrooms assumed their place in the drug-using subculture along with other psychoactive drugs such as LSD, MDA, and cannabis.

Historically, the legal status of psychoactive mushrooms has been somewhat confused. While in most countries possession of the chemicals psilocybin and psilocin (a related analog) is illegal, possession of mushrooms containing these substances may be legal. In the United States, both psilocybin and psilocin are prohibited under the Federal Controlled Substances Act as Schedule I drugs. Psilocybin mushrooms are also considered to be illegal (Shulgin, 1980). In Canada, the drugs are currently considered to be Restricted Drugs under the Food and

Drugs Act, along with such drugs as LSD and MDA. However, a recent decision in Canada (1979) ruled that while possession of psilocybin in its chemical form was illegal under the Food and Drugs Act, possession of psilocybin-containing mushrooms violated no laws. The issues surrounding the legal status of psilocybin mushrooms are discussed in greater detail at a later point in the paper.

Pharmacology

The type of mushroom used most frequently in British Columbia for its psychoactive properties belongs to the genus Psilocybe. There are many species of Psilocybe mushrooms, but all species which are psychoactive have in common the presence of psilocybin and frequently psilocin. These substances were first isolated by Albert Hofmann, the discoverer of LSD, in 1958. The phosphate derivative psilocybin (4-phosphoryloxy-N, N-dimethyltryptamine) was the first naturally occurring phosphorylated alkaloid discovered. It is a stable compound which is obtained in colourless crystals and has a melting point of 185° - 228° C. Psilocybin is soluble in dilute acids and water, poorly soluble in methanol and virtually insoluble in other organic solvents. Psilocin, the free analog (4-hydroxy-N, N-dimethyltryptamine), is not phosphorylated but is equally active. Psilocin forms white crystals from methanol, is unstable in solution, and has a melting point of 173° - 176° C. It is quite insoluble in water, but dissolves in most organic solvents (Hofmann, 1971; Hollister, 1968; Shulgin, 1980).

As with many other psychoactive chemicals, the particular means by which psilocybin acts on the body to produce its effects are poorly understood. It appears that psilocybin exerts its psychic effects through central sympathetic excitation (ergotropic arousal). In contrast, THC, the active component of marijuana, produces psychoactive effects mainly by parasympathetic excitation or trophotropic arousal (Shaffer, Hill, & Fischer, 1973). The central nervous system effects of psilocybin are exerted only after the drug has been converted to psilocin in the body. Psilocin, then, is the active metabolic form of psilocybin and is about 1.4 times as potent as is psilocybin (Aboul-Enein, 1971; Hofmann, 1971; Wolbach, Miner, & Isbell, 1962). Psilocin has been found to be structurally related to the major neurotransmitter serotonin, as both are tryptamine derivatives, and this similarity may account for psilocin's psychoactive activity (Chilton, Bigwood, & Jensen, 1979; Hofmann, 1971). As hallucinogenic drugs such as LSD, DMT, mescaline, and psilocin produce similar psychic effects in man, they may also have common physiological effects. It appears that these drugs all inhibit or interfere in some way with the neurotransmission of serotonin in the brain. Serotonin and other neurotransmitters are thought to be intimately involved with the expression of emotion and other behavioural and motor functions controlled by the brain. The relationship between hallucinogenic drugs and serotonin is supported by early studies in humans indicating that the psychoactive effects of such drugs were partially blocked by drugs that increased brain serotonin neurotransmission (Chilton et al., 1979; Jacobs & Trulson, 1979).

In humans and animals, psilocybin is rapidly dephosphorylated to psilocin. A study using rats found that about half of the psilocin administered orally was absorbed by the gastrointestinal tract and passed into the bloodstream. Within half

an hour this psilocin had been distributed almost uniformly in body tissue, including the brain. Local concentration was limited to the liver and adrenals. Psilocybin administered to mice was found to accumulate in the form of psilocin in the kidney, liver, and brain. The peak concentration in the liver and kidney, which occurred 20-30 minutes after administration, preceded peak concentration in the brain by about 12 minutes. Within four hours following administration, the level of psilocin in all tissues had fallen to near zero with the exception of the liver and adrenals where a significant amount of psilocin was still detected after 48 hours (Balestrieri, 1960; Kalberer, Kreis, & Rutschmann, 1962).

In the brain, the rate of decline of psilocin corresponds well with the length of time that the psychic effects last. Studies on the brains of rats have shown that the highest concentration of psilocin is in the neocortex, hippocampus, and thalamus. Hopf and Eckert (1969) suggest that the high uptake of psilocin in the hippocampus and neocortex may explain some of the behavioural effects of the drug. The level of psilocin in the brain is about the same as that in the blood and other tissues during the elimination period. This contrasts sharply with LSD which has a low brain/blood ratio and which is several orders of magnitude more effective in the brain than is psilocybin (Chilton, 1979; Kalberer et al., 1962). Approximately 65% of the dose of psilocin is excreted in the urine and 15% to 20% in the bile and feces within 24 hours of drug ingestion. Most of this excretion takes place within the first 8 hours, but 10% to 20% of the drug is retained for a greater time. As a result, significant quantities of metabolites can be detected in the urine even after seven days. About 25% of the psilocin is excreted unaltered (Kalberer et al., 1962).

It has been observed that certain types of mushrooms, particularly those of the Psilocybe genus, tend to stain blue, especially when bruised. This bluing phenomenon has been linked to the presence of psilocybin or psilocin in the mushroom (Benedict, Tyler, & Watling, 1967). The intensity of the bluing generally seems to be correlated with the quantity of these drugs present. Although the bluing process has not been studied in great detail, it is believed that psilocybin mushrooms contain an enzyme which converts psilocin to a blue product with the consumption of oxygen (Levine, 1967; Pollock, 1976). There may exist a relationship, then, between the bluing capacity of a mushroom and its ability to produce psychoactive effects. However, all mushrooms which stain blue are not psychoactive. Indeed, some mushrooms which stain blue but do not contain psilocybin are poisonous (Lincoff & Mitchel, 1977).

Recently, two new tryptamine derivatives with hallucinogenic properties have been found in several varieties of Psilocybe mushrooms. The two chemicals, baeocystin and norbaeocystin, exist in several varieties of Psilocybe mushrooms, some of which grow in British Columbia (e.g., P. semilanceata, P. stunzii, and P. baeocystis). Although little is known about these chemicals at the present time, they do appear to be somehow related to psilocin, as baeocystin has never been detected in the absence of psilocin (McDonald, 1980; Repke & Leslie, 1977; Repke, Leslie, & Guzman, 1977). Psilocybe baeocystis mushrooms are suspected of having caused the death of a young child several years ago. However, the role of baeocystin in this death and even the identity of the mushroom responsible have been questioned. At the time of the child's death, baeocystin was thought to be unique to Psilocybe baeocystis mushrooms, but baeocystin has since been found in

several other commonly-ingested species of Psilocybe mushrooms. No other reports of serious adverse effects from P. baeocystis have been noted in the literature (Pollock, 1975; Repke et al., 1975; Singer, 1978).

Analysis of several specimens of mushrooms from the Pacific Northwest for the presence of psilocybin and/or psilocin has been conducted by Dennis McKenna of the University of British Columbia (Vancouver). While the specimens analyzed do not constitute a representative sample of psilocybin mushrooms ingested in this area, they do indicate the variability in the potency of psychoactive mushrooms, even within a species. Twelve specimens of Psilocybe mushrooms of the baeocystis, stunzii, cyanescens, strictipes, and semilanceata species originating in either Olympia, Washington or Vancouver, B.C. were analyzed during 1979 and 1980. The highest concentration of psilocybin was found in a Psilocybe cyanescens specimen from Vancouver (10.7 mg/g dry weight) and the highest concentration of psilocin was in a P. baeocystis specimen from Olympia (1.8 mg/g dry weight). One of the Psilocybe stunzii samples did not contain either psilocybin or psilocin. Although one specimen of P. baeocystis (which is generally considered to be the most potent of the local Psilocybes) from Vancouver contained 8.1 mg/g of psilocybin, the two other samples of this species from Olympia contained only 1.0 mg/g and .62 mg/g of psilocybin respectively. The eleven specimens containing psilocybin had an average psilocybin content of 5.0 mg/g dry weight or .5%. This is similar to the average psilocybin content of less than 1% reported in the literature. The average psilocin content of the nine specimens containing psilocin was .6 mg/g dry weight or .06%.

Effects

Clinical Studies. Researchers have studied the effects of psilocybin mushrooms on both animals and humans in clinical settings. While the effects of psilocybin have been shown to be similar to those of LSD and mescaline, psilocybin is 900-1,000 times less powerful than LSD but 90 to 100 times more powerful than mescaline. Psilocybin also has a shorter duration of action than LSD (Aboul-Enein, 1971; Hollister, 1968; Lerner & Katsiaficas, 1969).

Studies using animals have demonstrated that the physiological effects of psilocybin are relatively minor. Weidmann et al. (cited in Hofmann, 1971) found that psilocybin does not provoke any typical effects on isolated organs except for a characteristic inhibition with respect to serotonin, resulting in such effects as mydriasis (dilation of the pupils), piloerection (erection of the hair), tachycardia (rapid heart beat), and hyperthermia (fever). These effects are due to psilocybin's influence on the sympathetic structures of the brain. Motor behaviour was found to be somewhat hampered. Chauchard (cited in Aboul-Enein) found that the administration of psilocybin to rats and mice caused excitation followed by a period of reduced motor activity. Kotowski et al. (cited in Aboul-Enein, 1971) interpreted this excitation in mice and rats as aggressive behaviour, but found that this behaviour depended on certain factors including isolation time, time after injection, and type of test. Meldrum and Naquet (1970) report effects in baboons such as increased spontaneous eye movements and reduced generalized motor activity. Piloerection, depression, exophthalmos (abnormal protrusion of the

eyeball), and some hindleg ataxia were noted by Horita (cited in Pollock, 1976) as the major physiological effects of psilocybin in mice. Psilocybin has been found to be of low toxicity in animals and at the present time no major toxic effects are known. Tolerance to the effects of psilocybin has been observed in animals, but this tolerance disappears several weeks after withdrawal (Aboul-Enein, 1971).

Stein, Closs, and Gabel (1959) report on a series of tests involving the administration of Panaeolus venenosus and Psilocybe caerulescens mushrooms (both of which contain psilocybin) to a normal human subject. Effects elicited by both types of mushrooms included reduction in pulse rate, overall steadiness of both systolic and diastolic blood pressure, dilation of pupils, drop in body temperature, and sweating. Subjective effects were experienced mainly with Panaeolus mushrooms and included a mild or moderate relaxed type of inebriation, disturbed equilibrium, blocking in the psychic thought processes, and tingling in the fingers. Psilocybe mushrooms induced yawning, a burning sensation in the stomach, a feeling of tiredness, and a feeling of anxiety with a sense of strong intoxication. No visual distortions or hallucinations were perceived, although it should be noted that the maximum dose (5g) was relatively low.

A study by Delay, Pichon, and Lemperiere (cited in Singer, 1978) examined the effects of psilocybin (the pure alkaloid) on 20 normal subjects and 63 mental patients. The major effects on all subjects involved individual modifications which were mainly reactions related to affectivity. Mental patients generally demonstrated a lifting of reserve and inhibitions, which the authors found useful for purposes of psychotherapy. All subjects had an urge to recall or relate experiences they had while under the drug's influence. Baer (1967) reports on a study involving the administration of two psilocybin derivatives to 36 normal subjects. In this study, the experimenters attempted to minimize external stimuli and to avoid any suggestions to the subjects as to the expected results. Physiological effects on subjects included slight increases in pulse rate, body temperature, and blood pressure, nausea, hypersalivation, mydriasis, increased reflexes, and co-ordination disturbances. The most frequently reported subjective experiences were distortions in body image and visual illusions or hallucinations. Euphoria, dysphoria, restlessness, paranoia, depersonalization, psychotic and panic reactions, auditory hallucinations, and cosmic-mystic experiences were also observed. It is interesting to note that no subjective experiences occurred in 14% of the total of 80 experimental sessions.

A self-report by Stein (1958) describes a rather unpleasant period of intoxication due to Psilocybe cubensis. In addition to physiological effects such as piloerection, dilated pupils, rapid shifts of temperature sensations, and tiredness, the author also experienced feelings of disorientation, an inability to concentrate on tasks and strong feelings of anxiety. A moderate hangover was observed. Stein's experience does not appear to be typical of the majority of self-reported experiences with psilocybin which are mainly pleasant (Singer, 1978), yet it does point to the variety of individual responses.

Reported Effects. The potency of psilocybin mushrooms varies somewhat with the manner of preparation and ingestion. The mushrooms may be eaten fresh by themselves, fried in butter, cooked in omelettes with other foods, brewed in tea,

or even smoked. The effects will be more powerful when the mushrooms are eaten on an empty stomach (Lincoff & Mitchel, 1977). Frequently, the mushrooms are dried and stored for future use. The potency of the mushroom is reduced by about half when dried and may further deteriorate over time. Dried mushrooms generally contain less than one percent psilocybin (Shulgin, 1980). When psilocybin mushrooms are sold on the street, it is most often in the form of dried mushrooms. Synthetic psilocybin is rarely, if ever, encountered. Although the drug exerts effects both orally and parenterally (parenteral administration enhances potency somewhat), parenteral administration outside of the clinical setting is rare due to the unavailability of synthetic psilocybin.

In most cases, the effects of psilocybin become apparent within 20 to 30 minutes after administration and develop with startling rapidity over the next 20 minutes (Shulgin, 1980). The frequency and intensity of effects increase with dose. The most intense effects, which are experienced about 60 minutes after ingestion, rarely last more than an hour. Overall effects usually persist for three to five hours gradually diminishing in intensity and often ending with a feeling of tiredness. (Hollister, 1968; Mitchel & Rumack, 1978).

At low doses of 5 to 10 mg of psilocybin (equivalent to one to two grams of dried mushrooms), effects are generally mild. Some alteration in mood, either euphoria or dysphoria is produced, and concentration and attention are disturbed so that psychological functioning is impaired. In some cases, dizziness, nausea, weakness, and sensitivity to light may occur (Hollister, 1968; Puget Sound Mycological Society, 1973). Hofmann (1971) describes a feeling of intellectual and bodily relaxation and detachment from the environment. Sometimes a pleasant feeling of physical tiredness and heaviness can occur, but this may be accompanied by a feeling of extraordinary lightness (Hofmann, 1971).

At higher doses (10-30 mg), more profound psychic changes are prominent and are frequently associated with alteration in spatial and body image (Hofmann, 1971). After about 30 minutes, the user may experience dizziness, giddiness, nausea, weakness, muscle aching, twitching, and shivering. Numbness of the tongue, lips or mouth may occur. Feelings of tension or restlessness may predominate in these early stages (Hollister, 1968). Over the next hour, distortions in perception become apparent and the user may enter a dream-like state. Blurred vision, brighter colours, and visual patterns may be experienced and acuity of hearing may increase. Loss of attention and concentration, slowed thinking, and feelings of unreality and depersonalization have been reported. In addition, the user may have difficulty in co-ordinating bodily movements and in speaking (Chilton, 1978; Hofmann, 1971; Hollister, 1968). During the next hour, the visual effects increase in intensity. Coloured shapes and patterns and a wave-like motion of viewed surfaces generally produce a pleasing effect, although frightening images may sometimes occur. In the absence of visual and auditory input, the experience can be largely fantasy and rich with hypnagogic imagery (Hollister, 1968; Shulgin, 1980). Perception of time is distorted, usually in the form of a slowed passage of time. For the most part, this is a euphoric or ruminative state accompanied by impaired performance (Hollister, 1968; Puget Sound Mycological Society, 1973). The next couple of hours see the continuation of the above states in varying degrees followed by the gradual waning of effects. Few aftereffects are

experienced, although occasional headache or fatigue resembling a mild hangover have been reported. The user is frequently in a serene, contemplative state which may persist for several days (Hollister, 1968; Pollock, 1974).

Doses higher than 30 mg produce an intense syndrome with visual illusions or hallucinations, distortion of body image, and variable mood changes. The duration of most extreme effects, however, is short-lived. There is an increased likelihood of post-drug effects such as headache, drowsiness, and mood changes with higher doses (Hollister, 1968). Although hallucinations are often reported in connection with psilocybin, the occurrence of true hallucinations is infrequent. Rather, pseudohallucinations or illusions due to visual distortion and alteration of other sensory functions, are far more common (Guzman, Ott, Boydston, & Pollock, 1976).

As mentioned previously, the known physiological hazards of psilocybin use are relatively minor. In general, changes in blood pressure, pulse rate, and bodily temperature are minimal, and feelings of nausea are often transitory. Users may experience uneasiness in walking, may misjudge distances and may be particularly reactive to sudden harsh noises (Mitchel & Rumack, 1978). This impairment of normal bodily functions may make activities such as driving an automobile while under the influence of psilocybin particularly hazardous. Psilocybin is not physically addictive in that no withdrawal symptoms are experienced, even after periods of heavy use. Tolerance is readily established after chronic administration (i.e., at least several times per week), but will disappear after a few weeks of abstinence. Cross-tolerance of psilocybin with LSD has been observed and is most likely due to the chemical similarity of the two drugs (both are tryptamine derivatives and probably exert effects on the body through similar mechanisms). However, while tolerance to LSD develops after psilocybin use, the reverse, tolerance to psilocybin after LSD use, has not been demonstrated (Aboul-Enein, 1971; Hofmann, 1971; Hollister, 1968).

Chronic Effects. Very little information pertaining to any long-term effects resulting from chronic ingestion of psilocybin is available. This may be due in part to the fact that magic mushroom use in modern society is a relatively recent phenomenon and so adverse long-term effects (if any exist) have not yet become apparent. However, the manner in which psilocybin is currently used may also be a factor. Anecdotal information indicates that most individuals who use magic mushrooms do so on a rather irregular basis, particularly outside of the limited fall mushroom season, and tend to limit the dosage consumed. Thus, chronic administration over a continuing period may be infrequent. Some study of the long-term effects of LSD, a drug similar to psilocybin in terms of acute effects, has been carried out. There is some indication that chronic use of LSD may be related to a variety of psychological problems and personality changes, but a causal relationship has not been established. Similarly, information linking LSD use to chromosome breaks and genetic damage in humans has not yet been confirmed (Commission of Inquiry into the Non-Medical Use of Drugs, 1973; Sankar, 1975).

Psychological Hazards. Although the physiological and psychological dangers of psilocybin use are minimal and most users seem to enjoy a pleasant experience, the potential for serious psychological consequences cannot be ignored. Like other hallucinogens, such as LSD and mescaline, psilocybin is a very powerful drug which

can have destructive psychological effects (Silverman, 1975-76). "Bad trips" or overdoses can result in the development of severe anxious and confused states which could lead to psychic trauma, particularly in adolescents. Such dangers readily explain why primitive peoples considered magic mushrooms to be taboo and reserved their use for ceremonial occasions (Hofmann, 1971). Users may also experience problems because of impaired behaviour and functioning while under the influence of psilocybin. For example, a young B.C. man, apparently under the influence of psilocybin, recently injured his spine by attempting to "fly" off a balcony (Poison Control Program, 1980).

The major factor in determining whether an individual is likely to have an unpleasant experience under the influence of psilocybin is the individual, himself. Hallucinogenic drugs do not create emotional events, but can only enhance the existing personality characteristics and emotional state of the user (Fischer, Fox, & Ralstin, 1972; Silverman, 1975-76). Drugs such as psilocybin may precipitate an underlying psychosis but they are generally not considered to be causative in this respect (Hollister, 1968; Pollock, 1975). If an individual is experiencing serious difficulties of a psychological or emotional nature or is in a state of anxiety at the time of drug-taking, it should not be surprising to find that psilocybin can exacerbate these conditions. While the strength of effects is usually related to dose, even the amount of psilocybin which constitutes an overdose is intimately related to the individual and his state of mind at the time of drug ingestion. In general, positive expectations and attitude lead to a pleasant experience and negative expectations result in an unpleasant experience (Hofmann, 1971; Shulgin, 1980).

The other major influence on the nature of the psilocybin experience is the setting in which the experience occurs. In Mexico, the ceremonial use of magic mushrooms has traditionally required adherence to certain conditions. The curandero or curandera presiding over the ceremony lives in a house apart from the rest of the village and can, therefore, control the setting in which the drug-taking occurs. Most frequently, ceremonies occur after dark and in dimly lit rooms where distracting visual and auditory cues are absent (Pollock, 1977-78; Singer, 1958). Because of psilocybin's ability to intensely affect sensory functions, it is likely that ingestion of the drug in such surroundings as a downtown bar or a large crowd would increase the potential for adverse reactions.

Prevalence

A mushroom is a fungus and like many types of fungi much of its structure lies beneath the ground. The visible part of the mushroom which is picked and consumed constitutes the fruiting or reproductive body of the fungus. If the structure of the mushroom beneath the surface of the ground is not substantially disturbed when the mushroom is harvested, the organism can continue to grow. Mushrooms grow extremely quickly under favourable conditions and an overnight rain may bring a multitude of mushrooms where none were visible previously (Pollock, 1977-78; Weil, 1975).

Psilocybe mushrooms are known to grow in abundance in many parts of North

America. While the western regions of Washington and Oregon appear to be the major centres of magic mushroom growth in the United States, Psilocybe mushrooms have also been reported in many other American states including California, Alabama, Michigan, Maine, Ohio, Tennessee, North Carolina, New York, and Florida. In Canada, British Columbia is regarded as the mecca for magic mushroom pickers, but Psilocybe mushrooms also grow to a lesser extent in both Ontario and Quebec (Pollock, 1975). Although the Psilocybe genus of mushrooms is considered to be the major hallucinogenic mushroom of the Pacific Northwest (i.e. Oregon, Washington, and British Columbia), psychotropic species of at least three other genera (Panaeolus, Conocybe, and Amanita) also grow in this area (Guzman & Ott, 1976; Guzman et al., 1976). Amanita muscaria mushrooms will be discussed briefly at a later point in the paper.

The most common Psilocybe mushrooms employed in the Pacific Northwest are Psilocybe semilanceata, sometimes referred to as "Liberty Caps" (Guzman et al., 1976; Pollock, 1977-78). Psilocybe semilanceata mushrooms (and other species of Psilocybe mushrooms) are found in British Columbia from the Queen Charlotte Islands south to the American border and from the central area of Vancouver Island east to the Fraser Valley. These small, delicate mushrooms are usually light brown in colour when dry. The cap of the mushroom varies in size from .5 cm to 2.5 cm broad, is generally conical in shape and viscid when moist. The spores are purplish-brown staining blue, and the slender and flexible stem is from 4 cm to 10 cm long. Its habitat is in grassy areas with rich soil, particularly pastureland, but it is also found in fields, meadows, parks, and even lawns. Psilocybe semilanceata is considered to be typical of most Psilocybes in terms of its psychoactive capacity (Haard & Haard, 1977; "Magic mushrooms of British Columbia", 1972; Pollock, 1977-78; Stamets, 1978; Weil, 1975). The season for Psilocybe mushrooms is usually from about the autumn equinox to the winter solstice, but heavy rains sometimes result in abundant fruitings out of season (Pollock, 1975-76).

It is thought that the name Liberty Cap originates from the French Cap of Liberty which was the symbol of the French Revolution. The shape of the Psilocybe semilanceata mushroom, particularly when dry, resembles this conical cap. The designation Liberty Cap is also given to another Psilocybe species found in the Pacific Northwest, Psilocybe pelliculosa. This is a woodland species which is often seen along paths in coniferous forests. The cap is conic to bell-shaped and chestnut brown in colour when moist. As with other Psilocybes containing psilocybin, P. pelliculosa turns a blue or blue-green colour when injured (Smith, 1975; Stamets, 1978). Other psychoactive Psilocybe species which grow in British Columbia and which are employed to a lesser extent than P. semilanceata, are P. stunzii, P. cyanescens, P. silvatica, P. strictipes, and P. baeocystis. The latter is considered to be the most potent of the Pacific Northwest Psilocybes and grows on decaying conifer mulch, in wood chips, and in lawns rich in lignin (Guzman et al., 1976; Haard & Haard, 1977; Stamets, 1978).

The first reports of the use of psilocybin mushrooms in British Columbia came in 1965 when R.C.M.P. officers seized mushrooms believed to be P. semilanceata from University of British Columbia Students (Pollock, 1977-78). At that time, official sources believed that the use of psychoactive mushrooms was limited to "a few exceptional experimenters" (Commission of Inquiry into the Non-

Medical Use of Drugs, 1973). However, others disagree and Pollock (1977-78), for one, believes that the use of magic mushrooms in B.C. increased by "leaps and bounds" throughout the 1960's. Unfortunately, there are no available statistics concerning the extent of magic mushroom use in British Columbia or Canada. Psilocybin has only recently become a drug of concern and traditional self-report surveys of drug use have not distinguished psilocybin from other hallucinogenic drugs such as LSD and MDA. In addition, the changing legal status of psilocybin mushrooms serves to confuse indicator data.

Conviction statistics for psilocybin offences under the Food and Drugs Act are not very informative in terms of the prevalence of use in Canada. Psilocybin did not become a proscribed substance until late 1974 and during that year only two convictions (both in Ontario) were recorded. In 1975, psilocybin convictions totalled seven, two of which occurred in Saskatchewan, three in Alberta, and two in B.C. The next year, 25 convictions were recorded, 17 (68%) of which took place in B.C. Psilocybin convictions more than tripled in 1977 to 78, 55 (71%) of which were recorded in B.C. and 10 (13%) in Alberta. Again, in 1978, B.C. had the vast majority (120 of 149 or 81%) of all psilocybin convictions nation-wide. During 1979, the latest year for which data are available, a significant change from past years in the location of offences was apparent. Of the 86 convictions reported in 1979, only 22 (48%) occurred in B.C. The rest of the offences were spread out across the other provinces with 17 (20%) in Alberta, 10 (12%) in Ontario, and 17 (20%) in Quebec (Bureau of Dangerous Drugs, 1974-1979).

Drug analysis programs, which undertake analyses of street drugs, provide some limited information on both the prevalence of use of a drug and on practices surrounding its use. In Ontario, the street drug analysis program of the Addiction Research Foundation analyzed only one sample alleged to contain psilocybin from fiscal year 1975-76 to 1977-80. No psilocybin was found. Federal Health Protection Branch laboratories, which conduct analyses of seized drugs for purposes of identification for court cases, identified 150 psilocybin exhibits in 1978-79 and almost twice that (289) in 1979-80. Only 23 samples (15%) in 1978-79 came from Alberta or British Columbia (these two provinces are combined in reporting statistics), but more than half (82) of the psilocybin samples were seized in Ontario. In 1979-80, 118 (41%) of the 289 samples were seized in B.C. or Alberta, 84 (29%) in Quebec, and 58 (20%) in Ontario (Addiction Research Foundation, 1981).

The two sources of information discussed above demonstrate that magic mushroom use is not a phenomenon unique to British Columbia. Particularly in recent years, psilocybin has been showing up with some frequency in Ontario and Quebec. It is not at all inconceivable that a combination of word-of-mouth communication and media publicity about Psilocybe mushrooms and their legal status, has served to draw those interested in the mushroom's psychoactive effects, or perhaps its dollar power, to British Columbia. A pound of dried Psilocybe mushrooms is apparently worth $2,000.-$3,000. on the street, a rather attractive incentive for Easterners to make a fall pilgrimage to B.C.

It is very difficult to try to determine the actual prevalence of magic mushroom use from available information. However, on the basis of media articles

and anecdotal reports, it appears that a substantial number of persons in B.C. have tried psilocybin mushrooms and that this number has increased during the past couple of years. Little is known concerning patterns of use, but it would seem that use is most prevalent during the mushroom season in the fall and only sporadic during the rest of the year. Pollock (1977-78) states that the use of psilocybin mushrooms for ecstatic experiences generally continues to be incorporated into the fabric of modern society.

Treatment

This section addresses some of the concerns in the treatment of adverse effects resulting from psilocybin mushroom ingestion. It is not intended, however, to be a guide for those treating psilocybin-intoxicated individuals. The physical dangers of psilocybin mushroom ingestion by adults, as discussed previously, appear to be minimal. Children, however, may be much more susceptible to adverse reactions than are adults. It has been reported that children who have ingested psilocybin mushrooms have experienced high temperatures of 102° F - 106° F and intermittent tonic-clonic convulsions. The reasons for the particular sensitivity of children to mushrooms are not known (Mitchell & Rumack, 1978; Puget Sound Mycological Society, 1973). Users who attempt to purchase psilocybin mushrooms on the street may not obtain psilocybin at all, as other substances are frequently misrepresented as psilocybin. For example, cases have been reported in which ordinary market mushrooms have been mixed with LSD or PCP (angel dust) and sold as psilocybin mushrooms (Pollock, 1975). On the other hand, those who pick their own mushrooms, particularly unexperienced pickers, run the risk of ingesting a poisonous mushroom by mistake.

The only Psilocybe species known conclusively to have caused actual physiological poisoning (as compared to psychoactive effects or minor reactions such as nausea) are P. argentipes and P. venenata, but these species are not believed to be ingested in this area. Cases of poisoning attributed to P. baeocystis may or may not have been caused by this mushroom, as discussed previously. The medical treatment for cases in which psilocybin mushrooms have been ingested involves treatment of both minor physiological symptoms, such as nausea and tachycardia, and behavioural difficulties, including agitation, hallucinations, and psychosis. In general, behavioural problems are best treated by oral administration of minor tranquilizers, such as diazepam and chlordiazepoxide. Symptomatic treatment is normally sufficient since recovery is usually rapid and complete. However, it can be difficult to determine the particular mushroom responsible for the presenting symptoms from a verbal description alone. Consequently, medical personnel must consider the possibility that deadly poisonous mushrooms are involved. Cases involving symptoms such as nausea and abdominal cramps may be treated by means of gastric lavage and inducing vomiting, although such treatment would rarely be required when dealing solely with psilocybin mushrooms. (McCabe, 1977; Mitchel & Rumack, 1978; Pollock, 1975; Puget Sound Mycological Society, 1973).

Both LSD and psilocybin have been known to produce some atropine-like effects. For this reason, and because of the possibility that psilocybin mushrooms purchased on the street may contain some atropine-like contaminants, some

believe that the use of chlorpromazine should be discouraged (Guzman et al., 1976; McCabe, 1977; Pollock, 1975). However, Singer (1978) and Mitchel and Rumack (1978) have found chlorpromazine useful for terminating hallucinations and alleviating the psychotic state in severe cases. Treatment setting is considered to be important in handling psychedelic drug crises. Attempts should be made to eliminate extraneous noises, interruptions, and interferences, and to make the setting comfortable. While "talking down" the patient is sometimes effective, McCabe (1977) suggests that encouraging the patient to "go with" the experience rather than fight it may be more effective.

Another consideration in dealing with adverse reactions due to psilocybin mushrooms is the possibility that other drugs or alcohol may have been ingested along with the mushrooms. While attempts should be made to determine if this has occurred, it is not always possible to obtain this information. An examination of the literature revealed little data on the effects of consuming combinations of drugs including psilocybin. However, it is likely that combining psilocybin with other drugs, including alcohol, could have serious adverse consequences in some cases. While the incidence of multiple drug ingestion involving psilocybin is not known, it is probable that drugs such as cannabis and alcohol are at least occasionally taken in combination with psilocybin.

Data from the Vancouver office of the federal Poison Control Program give some indication of the frequency with which adverse reactions to magic mushrooms occur. While these data represent about three-quarters of British Columbia hospitals, they are by no means comprehensive, as reporting is not complete. In addition, positive identification of the mushroom responsible is rarely available and the involvement of other drugs is frequently unknown. While some of the following cases may have been caused by Amanita muscaria, the majority are believed to have been due to psilocybin mushrooms. In 1979, 41 cases of magic mushroom poisoning were reported, 33 of which involved males and 8 of which involved females. This increased to 66 cases in 1980, 44 of which were male. Most of the individuals involved were in their late teens or early twenties and few reported any serious adverse effects. More than a third of the cases reported no symptoms or minor symptoms such as nausea, vomiting, and headache. Eight cases presented some type of psychotic behaviour, but several of these were known to involve ingestion of alcohol or other drugs. One man suffered a serious spinal injury attempting to "fly" off a balcony. Although the quantity of mushrooms ingested is infrequently reported, the majority of known cases involved relatively large amounts of mushrooms. Preliminary data for 1981 indicate a slight decrease in the incidence of reported poisonings.

Legal Status and Implications

Psilocybe mushrooms pose several rather unique problems in terms of the use of indigenous psychoactive substances in our society. At this time, magic mushrooms appear to be the only naturally-occurring powerful psychedelic found and used to any extent in Canada, yet it is not at all inconceivable that other plants and fungi will be found to have psychoactive properties. Indeed, Schultes (1966) believes that if more research were conducted in this area, many such

substances would be uncovered in North America. The legal dilemma caused by indigenous hallucinogens has been amply demonstrated in B.C. through the example of Psilocybe mushrooms. Although marijuana and mescaline (which is found in the peyote cactus) are also naturally-occurring psychoactives, neither of these grow wild to a significant extent in B.C. In addition, both have been proscribed by law for many years, before, in fact, the boom of interest in mind-altering substances in the 1960's. In late 1974, the federal Food and Drugs Act, which deals with hallucinogenic drugs such as LSD and MDA, was amended to include the chemicals psilocybin and psilocin as Restricted drugs. Although no mention was made in the Act of substances containing psilocybin or psilocin, it is probable that the original intention of the amendment was to cover psilocybin mushrooms as well.

For several years the Act was interpreted as meaning that possession of mushrooms containing psilocybin was illegal, and persons possessing or selling these mushrooms were arrested. In December, 1979, a B.C. Court of Appeal decision ruled, in essence, that while the chemical psilocybin was a proscribed substance, the psilocybin-containing mushroom was just that, a mushroom. Legal difficulties, however, did not end with this ruling. A problem which was becoming more apparent with the growing interest in magic mushrooms was one related to the source of supply. Psilocybe semilanceata, B.C.'s most popular psilocybin mushroom, grows most abundantly in fields and pastures. This habitat, of course, is mainly farmland which is under private ownership. Media reports of 1980, in particular, are rife with stories of magic mushroom pickers damaging farmers' crops, releasing livestock, consuming beer and other drugs in the fields, and refusing to abide by owners' requests to leave the property (Daniels, 1980; "Magic mushroom pickers plague Duncan residents", 1980; McParland, 1980; Tafler, 1980). This situation resulted in serious conflict between pickers and farmers in some areas. So-called vigilante groups of farmers attempted to forcibly remove pickers from their lands because the farmers found that B.C.'s trespass laws did not deter pickers. Trespass laws in force at that time required that the landowner, himself, must personally identify the trespasser and attempt to make him or her leave before police could be called in and a charge laid. Reports of violent attacks by farmers against pickers involving firearms, clubs, and bats, appeared with frequency in the media in the fall of 1980 ("Island farmers' vigilantes", 1980; Oake, 1980; Swan, 1980). Some farmers, on the other hand, preferred to reap financial gain from the situation by charging pickers substantial fees for access to their lands.

While changes to the federal Food and Drugs Act were urged by provincial authorities to make possession of the mushrooms illegal, the B.C. government attempted to deal with the problem itself by strengthening its trespass laws. In August, 1981, changes were enacted to allow police officers to arrest, without a warrant, anyone found trespassing on clearly posted property or anyone believed to have recently departed such property. This change appears to have resulted in an increase in the number of persons charged under the Trespass Act in September and October of 1981. In some areas, such as Courtenay on Vancouver Island, fines up to $250 and jail sentences of 30 days were imposed on mushroom pickers convicted under the new law ("Mushroom pickers jailed", 1981; "113 mushroom pickers charged", 1981). While it appears that such strict treatment of offenders may have had some effect in deterring the number of pickers on private land, there is some

question as to whether or not this approach, and the probable uneven enforcement of the law against one group, is appropriate ("Is the lock-up the answer?", 1981). It should also be noted that the Trespass Act has no influence on those who search for magic mushrooms on public property such as university grounds and city boulevards.

Federal legislation to make possession of substances containing psilocybin illegal under the Food and Drug Acts is reportedly under way ("Magic mushrooms may soon be illegal", 1981; "Ottawa to outlaw possession of magic mushrooms", 1981) but to date no changes have been made. Even if psilocybin mushrooms are made illegal, problems stemming from the natural and abundant growth of this mushroom in B.C. would still exist. For example, could landowners on whose farms or lawns magic mushrooms grow be charged with possession or cultivation? Would only the possession of the mushrooms outside their natural habitat (i.e., once they have been picked) be considered illegal? Are police capable of distinguishing between legal and illegal mushrooms on sight? Would involvement of the criminal element increase? Should a massive government campaign be undertaken to try to eradicate psilocybin mushrooms from B.C.? Would mushroom users switch to other, perhaps more dangerous, psychoactive drugs? It is conceivable, of course, that making psilocybin mushrooms illegal may have little effect in curtailing their use in British Columbia in view of the widespread availability of the mushrooms and their apparent growing popularity.

Other countries, such as Australia and Great Britain, have faced similar problems with respect to psilocybin mushrooms and have not found easy solutions (Hall, 1973; Pollock, 1977-78). The current situation regarding to Psilocybe mushrooms is a rather novel one for this country which has not had to deal with the issues surrounding indigenous psychoactives previously. From this example, it is obvious that such issues are complex and cannot be dealt with solely through legal sanctions.

Amanita Muscaria

Although this paper is directed toward an examination of psilocybin mushrooms, mention should be made of another type of magic mushroom used to some extent in British Columbia. Amanita muscaria, sometimes known as the fly agaric, is a psychoactive mushroom which also has a long history of use in many parts of the world, particularly in Siberia. In fact, Gordon Wasson believes that Amanita muscaria represents the ancient plant god Soma depicted in the Rig Veda, India's earliest known holy book and the basis of modern Hinduism. The identity of Soma (which is no longer used in India) has been a point of controversy for some time, but evidence does suggest that A. muscaria may indeed be the Soma plant (Ott, 1976; Wasson, 1968). It is possible, then, that one of the world's largest religions may be a direct outgrowth of a psychoactive mushroom (McDonald, 1978). Amanita muscaria is also believed to have played a role in Mayan civilizations in Guatemala (Lowy, 1977). Interest in Amanita muscaria grew in the 1960's along with interest in other natural and synthetic hallucinogens.

Certain species of the Amanita genus of mushrooms are highly toxic, as

evidenced by the fact that Amanita mushrooms are responsible for 95% of the fatal cases of mushroom poisoning in the world (Hatfield & Brady, 1975). In Canada, most of the serious cases of mushroom poisoning are due to a non-psychoactive Amanita, A. virosa, which contains potentially lethal amotoxins and phallotoxins (Lough & Kinnear, 1970). Amanita muscaria, while capable of causing unpleasant side effects, is not considered to be one of the deadly poisonous species. The major active chemicals of A. muscaria responsible for its psychoactive effects are ibotenic acid and muscimol. In terms of chemical structure, these drugs are unrelated to psilocybin. Ibotenic acid and muscimol have been shown to produce hallucinations, delirium, muscle spasms, and sleep (Waser, 1967). The chemical muscarine, which has anticholinergic properties and can cause vomiting, diarrhea, bradycardia, shortness of breath, and even death, if large amounts are taken, is found in only trace amounts in A. muscaria (Haard & Haard, 1977; Lough & Kinnear, 1970; Singer, 1978).

The effects of Amanita muscaria vary depending on the dose, the individual, and the circumstances. Reported effects include nausea, tiredness, apathy, salivation, hallucinations, time distortion, dreaminess, lack of muscular co-ordination, twitching, and auditory, bodily, and visual distortions (McDonald, 1978; Ott, 1976; Singer, 1978). As with psilocybin mushrooms, little study of any long term effects associated with the use of Amanita muscaria has been undertaken. In treating cases of adverse reactions to A. muscaria, atropine is not recommended as it exacerbates the toxic effects of muscimol and ibotenic acid (Haard & Haard, 1977; Mitchel & Rumack, 1978).

The extent of use of Amanita muscaria in British Columbia is not known. However, anecdotal information indicates that this mushroom is used to only a minor extent, much less so than psilocybin mushrooms. Amanita muscaria has a reputation, perhaps undeserved, for being poisonous and this may account for its lower rate of use. It is also less populous than the widely available Psilocybes. The danger of picking a more deadly mushroom by mistake may be even greater in the case of Amanita muscaria mushrooms than Psilocybe mushrooms. Amanita muscaria closely resembles certain deadly species of Amanitas and it may be discovered too late that a very poisonous species has been consumed rather than the mildly toxic A. muscaria.

Conclusions

From a review of the literature, it does not appear that the consumption of psilocybin mushrooms in British Columbia constitutes a significant health hazard at this time. The known physiological effects of acute psilocybin intoxication are minor and serious adverse psychological consequences are relatively infrequent. However, as with other powerful psychoactive drugs, unpredictable and damaging experiences have been known to occur. In particular, persons with existing or underlying psychological difficulties may run a greater risk of experiencing adverse reactions. The individual's own state of mind and attitude at the time of drug ingestion, along with the setting in which the drug-taking occurs, have been shown to be the major determinants of whether the psilocybin experience will be a pleasant or an unpleasant one. In discussing the potential negative consequences

of psilocybin use, mention must also be made about the lack of information regarding long-term effects of regular use. In addition, the effects of ingesting psilocybin in combination with alcohol or other drugs are not known. It is likely, however, that such combinations would increase the hazards for users. Perhaps the major danger in the use of magic mushrooms is not the consumption of psilocybin mushrooms, but the accidental consumption of poisonous mushrooms. For example, a species which is frequently encountered by those looking for psilocybin mushrooms in B.C. is the deadly poisonous Galerina autumnalis, which often grows in close proximity to Psilocybes (Stamets, 1978).

At the present time, the use of psilocybin mushrooms in B.C. is not widespread but it does appear to be growing. Whether or not this growth is related to the generally increased interest in natural psychoactives, the rather ambiguous and fluctuating legal status of the mushrooms, the recent media publicity regarding psilocybin, or some other factor, is not at all clear. What is clear is that the issues relating to the use of magic mushrooms are far from simple. Historically, psychoactive mushrooms have played a prominent role in various societies for centuries and they appear to have found a place in modern society as well. Pharmacologically, though, the psilocybin mushroom is still only poorly understood in terms of its chemical make-up and the manner in which it acts on the body to produce its psychoactive effects. We have seen, too, that the related concerns surrounding the legal status of indigenous psychoactives, such as psilocybin mushrooms, can be quite complex. Magic mushrooms represent a unique phenomenon in terms of psychoactive drug use in Canada and one which may well demand greater attention in years to come.

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